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| TRANSMITTAL OF APPEAL BRIEF (Large Entity) | Docket No. 17655 |
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In Re Application Of: **Thomas S. Laubner et al.**

| Application No. | Filing Date | Examiner | Customer No. | Group Art Unit | Confirmation No. |
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| **09/966,221** | **09/28/2001** | **M. C. wimer** | **26794** | **2821** | **5888** |

Invention: **MICROSTRIP ANTENNA WITH IMPROVED LOW ANGLE PERFORMANCE**

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

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Theodore Naccarella

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Dated: **January 23, 2006**

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Patricia M. Frisoli

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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: **Thomas S. Laubner et al.**

Application No: **09/966,221**

Filing Date: **September 28, 2001**

Attorney Docket No: **17655**

Title: **MICROSTRIP ANTENNA WITH IMPROVED LOW ANGLE PERFORMANCE**

Art Group: **2821**

Examiner: **Wimer, M. C.**

Confirmation No. **5888**

**CERTIFICATE OF MAILING**

I hereby certify that this correspondence, along with any papers indicated as being enclosed, are being deposited as first class United States mail, postage prepaid, in an envelope addressed to: Mail Stop Appeal Brief - Patents, Commissioner for Patents, Post Office Box 1450, Alexandria, VA 22313-1450 on June 21, 2005.

Jan 23, 2006
Date

Patricia M. Frisoli

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Alexandria, VA 22313-1450

**Attention: Board of Patent Appeals and Interferences**

## APPELLANTS' BRIEF

This brief is in furtherance of the Notice of Appeal filed in this case on November 22, 2005.

### 1) REQUIRED FEE

The requisite fee of $500.00 set forth in §41.20(b)(2) is submitted herewith. If the submitted fee is insufficient, the United States Patent and Trademark Office (hereinafter "Office") is authorized to charged Applicant's Deposit Account No. 19-5425 for any shortfall.

## 2) REAL PARTY IN INTEREST

The present application is assigned to M/A-COM, Inc. Accordingly, M/A-COM, Inc. is the real party in interest.

## 3) RELATED APPEALS AND INTERFERENCES

The appellant, assignee, and the legal representatives of both are unaware of any other appeal or interference that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

## 4) STATUS OF CLAIMS

a. Claims canceled: 2 and 16

b. Claims withdrawn from consideration but not canceled: None

c. Claims pending: 1, 3-15 and 17-36

d. Claims allowed: 6 and 17

e. Claims merely objected to: None

f. Claims rejected: 1, 3-5, 7-15, and 18-36

g. Claims appealed: 1, 3-5, 7-15, and 18-36

Appealed claims 1, 3-5, 7-15, and 18-36 as currently pending are attached as Appendix A hereto.

## 5) STATUS OF AMENDMENTS

There are no un-entered amendments to the specification claims or drawings in this case.

## 6) SUMMARY OF CLAIMED SUBJECT MATTER

The invention as claimed is best illustrated in Figures 2A and 2B and described on page5, line 4 through page 6, line 11 of the specification. The invention relates to microstrip antennas with improved low angle performance while not diminishing performance closer to the zenith. Particularly, the present invention improves low angle gain of a microstrip antenna primarily by two features of the design. The first feature is a dielectric lens that entirely encapsulates a patch and refracts electromagnetic waves so as to increase the gain at low angles while not substantially affecting gain at higher angles. Page 5, line 21 to page 6, line 2. The second feature is placing the patch on a second ground plane raised above a first ground plane. The raised, second ground plane further enhances the refraction effect, thereby increasing radiation gain at low angles without diminishing gain at the zenith. Page 6, lines 2-5.

## 7) GROUNDS FOR REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1, 3-5, 7, 8, 14, 15, 18, and 23-36 stand rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 6,157,348 issued to Openlander (hereinafter Openlander) in view of U.S. Patent No. 4,051,477 issued to Murphy et al. (hereinafter Murphy).

2. Claims 9-13 and 19-22 stand rejected under 35 U.S.C. §103(a) as unpatentable over Openlander in view of Murphy as applied to claims 1, 3-5, 7, 8, 14, 15, 18, and 23-36 and further in view of U.S. Patent No. 5,381,577 issued to Nichols et al. (hereinafter Nichols).

## 8) ARGUMENT

During prosecution, the Examiner set forth a detailed explanation of the rejections in connection with at least the independent claims. The rejections need not be fully repeated herein. In short, the Examiner relied on Openlander as teaching use of a lens to increase low angle gain and on Murphy as teaching placing the first ground plane above and spaced apart from a second ground plane.

### I. The Proposed Combination of Openlander and Murphy is Not Obvious

The proposed combination is improper because (1) there is nothing in the prior art of record that would suggest to the skilled artisan any reason to combine the teachings of Murphy with the teachings of Openlander and (2) the prior art, in fact, teaches away from the proposed combination because the combination defeats several principles of operation of the primary reference. Furthermore, the Examiner used improper hindsight reconstruction in formulating the obviousness rejections.

#### A. The Combination is Improper Because There is No Suggestion to Combine The References

As set forth in MPEP § 2143, a prima facie obviousness rejection must establish three things.

> First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The proposed combination of Openlander and Murphy is improper because it does not meet the first or second prongs of the obviousness test set forth in MPEP

§2143, i.e., (1) a suggestion to combine or (2) an expectation of success.

The goal of Openlander is to increase low angle gain without increasing the height (profile) of the antenna. The most relevant portion of Openlander is found in column 5, line 55 through column 6, line 5, where it discloses:

> As shown in FIG. 4, a plastic package with thick side walls covers and protects the antenna 58. The plastic package, particularly the top cover thereof, 62 may be made of dielectric or the like and has or incorporates prisms 64 at the edges in order to redirect the radiation pattern. In one such embodiment, prisms included in the decorative cover lowered the radiation angle of the PIFA antenna 58 shown in FIGS. 3 and 4 from forty degrees (40°) to twenty degrees (20°) without increasing the height of the overall antenna 58 with its package 60. As disk, or patch, antenna generally have a high radiation angle of sixty degrees (60°) to ninety degrees (90°), the prisms 64 serve to provide a radiation angle in the antenna 58 in a range of approximately seventy degrees (70°) to twenty degrees (20°) from the horizon. A foam layer having adhesive on both sides 66 may serve as a cushion or contact in conjunction with the plastic base 40. The foam layer 66 may serve to seal the antenna 58 within the plastic package 60.

Murphy, on the other hand, teaches (in connection with Figure 6, for example) achieving "low angle, highly efficient radiation independent of the radiating aperture size by mounting the usual microstrip radiator structures on a pedestal formed in the ground plane surface, thereby creating an image radiator which can be used to modify the shape of the radiated beam from either a single radiator or from a phased array of such radiators disposed over a common ground plane surface". Column 2, lines 4-12.

Thus, while Murphy does teach a microstrip antenna having a first ground plane disposed above and apart from a second ground plane for purposes of lowering the radiation angle and Openlander teaches a microstrip antenna with a prism to increase low angle radiation, there is no reasonable combination of the two references suggested in the prior art.

Rather, Openlander and Murphy simply disclose two different ways to increase low angle radiation from which no benefit would be gained by a combination of the two.

(In fact, as discussed in detail in section I.B.2 below, a combination likely negates the low angle radiation gains achieved by either reference individually.) The two references simply teach two different ways of achieving a similar result and there is no basis to conclude that a combination of the two leads to any desirable result or synergy.

The Openlander and Murphy references are analogous to a first reference that teaches writing with a pencil and a second reference that teaches writing with a pen, respectively. Both references teach different ways to accomplish the same result, which is very different than suggesting any reasonable combination of a pen and pencil.

Although the present invention is not considered when evaluating whether a proposed combination is proper, for purposes of contrast, note that, in the present invention, the reason for the combination of the elevated ground plane with the lens is because raising the ground plane increases the effectiveness of the lens and the ease of manufacture of the lens. Specifically, in the present invention, the microstrip and first ground plane are raised above the second ground plane in order to make it possible to practically form a lens that will have the correct optical properties close to the radiating microstrip. More particularly, if the radiating microstrip is positioned directly on a large ground plane that extends transversely far beyond the microstrip, it would be very difficult to manufacture a lens with appropriate optical properties so close to the large ground plane. However, by placing the microstrip on a ground plane with transverse dimensions that are only slightly larger than the microstrip and then supporting that assembly above the second, larger ground plane via slanted support portions which provide open space immediately transversely adjacent the microstrip, it

is much easier to fabricate the lens. See, for instance, page 5, line 18 through page 6, line 6 of the present specification.

There is nothing suggesting this result (or any other benefit of a combination) in either of the references. In Murphy, the purpose is entirely different. In Murphy, the first ground plane is raised above the second ground plane a very specific distance so as to actually change the radiation pattern directly out of the patch. In the present invention, the spacing of the two ground planes has nothing to do with changing the radiation pattern out of the patch. It is only the lens that changes the pattern after the radiation is emitted.

Thus, there is no teaching leading the skilled artisan to such a combination nor would there be any reasonable expectation of success with such a combination.

### B. The Combination is Further Improper Because It, Not Only Changes, But Actually Defeats, At Least Two of the Principles of Operation of the Primary Reference

As set forth in MPEP §2143.02 (MPEP, page 2100-99):

> If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious. In Re Ratti, 278 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959).

#### 1. The Combination Defeats Openlander's Crucial Goal of Providing an Antenna with a Low Profile

As noted above, the goal of Openlander is to increase low angle gain without increasing the height (profile) of the antenna. Column 5, line 55 through column 6, line 5 (quoted above in section I.A)

The desire to provide a low profile antenna is repeatedly emphasized in Openlander. See, for example, (1) the first sentence of the abstract, (2) the first

sentence of the application ("This invention relates to antennae for wireless signal transmission, and more particularly to a low profile cellular antenna design meant for facilitating cellular telephone communications in an inconspicuous manner.", (3) col. 2, lines 45-49, (4) the first line of the summary of the invention, (5) col. 4, line 66 et seq., (6) the preambles of all of the claims.

As also noted above, Murphy teaches achieving "low angle, highly efficient radiation ... by mounting the usual microstrip radiator structures on a pedestal formed in the ground plane surface, thereby creating an image radiator which can be used to modify the shape of the radiated beam from either a single radiator or from a phased array of such radiators disposed over a common ground plane surface". Column 2, lines 4-12. Thus, while Murphy teaches a microstrip antenna having a first ground plane disposed above and apart from a second ground plane, the reason for doing so in Murphy defeats at least two of the main principles of Openlander in direct violation of the tenet of MPEP 2143.02 quoted above. Therefore, there is no motivation in the prior art to make the proposed combination.

Particularly, the purpose of providing the two, spaced-apart ground planes in Murphy is explained in column 3, line 24 through column 4, line 34. Specifically, Maxwell's equations dictate that the total portion of radiated energy at relatively low radiation angles along the ground plane surface increases as the height of the radiating aperture above the ground plane surface increases. For instance, this is illustrated in Figures 1-5 of Murphy. More specifically, Figures 1, 2, and 3 show the different radiation patterns as a function of the height of the aperture (the small circle in those figures) above the ground plane. Figure 4 of Murphy shows the radiator and the virtual reflected image radiator relative to the ground plane. Figure 5 shows the

different radiation patterns expected for the three different positions of the radiating aperture shown in Figures 1, 2 and 3.

Hence, Murphy is attempting to change the radiation pattern directly out of the radiating aperture of the microstrip by changing the vertical distance between the radiating aperture and the reflected image of the radiating aperture relative to the ground plane. As indicated in Murphy, this is accomplished by distances of ¼ or ½ of a wavelength. These are huge distances relative to the distances at issue in the present invention and Openlander. This combination would utterly defeat the primary objective of Openlander of having a low profile, inconspicuous antenna for a cellular telephone. Thus, whereas Openlander strongly emphasizes that his antenna must have a low profile, Murphy, on the other hand, spaces his two ground planes apart by at least ¼ of a wavelength. This would produce an antenna that was anything but low profile. Hence, the combination would defeat the primary goal of Openlander in contrast to the tenet propounded in MPEP 2143.02.

In fact, it is ironic that this is exactly why the slanted side portions recited in the only two allowed claims (i.e., 6 and 17) are significant. Specifically, as previously noted, the slanted sides make it easier to fabricate a low profile lens because they provide open spaces immediately transversely adjacent the microstrip. See, for instance, page 5, line 18 through page 6, line 6 of the present specification.

**2. The Combination Also Will Likely Defeat the Primary Goal of Both References of Providing an Antenna with Low Angle Gain**

Secondly, as noted above, the theory of Murphy is that the radiator itself will radiate at low angles, in which case, the prism of Openlander likely will have an undesirable effect, rather than a desirable effect. Particularly, the prisms 64 of

Openlander will change the radiation pattern out of Murphy's radiator. That is their very purpose. However, since the radiator of Murphy will directly be producing significant radiation at low angles and poor radiation at high angles, it is difficult to know how Openlander's lens would change Murphy's radiation pattern, but it quite possibly will make it too narrow or possibly even reverse Murphy's low angle pattern. Thus, at best, the result of the proposed combination is unpredictable (in which case, there would be no "reasonable expectation of success"). At worst, the proposed combination has the opposite effect to that desired by both references. Thus, it cannot be reasonably said that there is a suggestion in the prior art to combine the references.

### C. The Examiner Also Used Improper Hindsight Reconstruction in the Rejection

Applicant had made similar arguments to those above in sections I.A and I.B in response to previous Office Actions in this case. The Examiner addressed those arguments. Particularly, the Examiner found Applicant's arguments unpersuasive, asserting in the latest Office Action:

> Specifically, as now set forth above in the previous Office action, it can be seen that lowering the distance between ground planes (as taught by Murphy, et al.) can increase gain at zenith, while the lens structure in Openlander increases gain near the horizon (below 45 degrees). These two techniques may be employed together because the purpose in Openlander is not destroyed. A skilled artisan recognizes as obvious that these techniques may be employed in conjunction in order to establish the type of radiation pattern desired. It must be kept in mind that Openlander is concerned with the overall height of the antenna and does not want to increase it. He uses a lens to lower the radiation pattern in the range claimed by applicant. Murphy merely teaches to employ a ground plane disposed above the main ground in order to lower the radiation pattern toward the horizon. Hindsight is not employed in the obviousness rejection because the two techniques are known to compliment [sic] each other. Openlander designs his antenna according to Murphy et al. because the antenna is raised a particular amount above the ground plane and the ground plane of the car. Then Openlander

> employs his technique of lens action by providing the lens 60 in order to lower the beam to his specifications. See column 3, first paragraph and the paragraph bridging columns 5 and 6 of Openlander. Since evidence of obviousness has been set forth according to design criteria used in both references the claims at hand do not appear to define over the prior art.

In the primary rejection, the Examiner asserted:

> Murphy, et al are cited as teaching that it is known to decrease the radiation angle of a microstrip antenna by raising it above a second ground plane (see Figures 5-7 of Murphy, et al). The lens 60 in Openlander lowers the radiation beam below 45 degrees as claimed. It would have been obvious to employ the techniques of Murphy, et al in the Openlander et al. antenna, particularly since there are two ground planes employed therein. In other words, a skilled artisan would raise the antenna of Openlander to a predetermined height while maintaining enough pattern coverage in zenith, according to the realization in Murphy et al. Murphy et al. are merely cited to show that there is a trade-off between gain at zenith and at horizon when attempting to raise the antenna above a ground plane. One skilled in the art would not raise the antenna in Murphy et al at position "c" is [sic] one wants to maintain some beam pattern in the zenith.
>
> A skilled artisan would have found it obvious that there is no decrease in gain at zenith when the lens is employed in Openlander because Murphy shows at least three distances in Fig. 5 in which the patch may be disposed above the ground plane (30 in Fig. 6). When the distance "b" is chosen, for example, there is no decrease in gain at the zenith unless the distance "c" is employed. Since Openlander uses the lens to provide improved gain below 45 degrees, one skilled in the art would not choose to raise the antenna to distance "c" according to Murphy et al. Distance "b" would be useful. Thus, a skilled artisan would lower the distance between ground planes, say for example from "c" to "b" as taught by Murphy et al. in order to maintain a usable gain at the zenith. The same could be said by lower the distance from "b" to "a" and then employing a lens to provide more pattern toward the horizon. Trade-offs occur when specific patterns are desired. A skilled artisan recognizes the techniques used by both patentees and utilizes them according to need.

The Examiner has used impermissible hindsight reconstruction. The whole point of Figure 5 and the related text of Murphy (column 3, line 65 through column 4, line 31) is that, as the radiator 16 increases in height above the primary ground plane up to one-half of a wave length, the gain at zenith decreases as the low angle gain

increases. However, that is not the teaching necessary for a proper obviousness rejection in this case. The teaching that is necessary is a suggestion to combine the raised ground plane of Murphy with the lens of Openlander. Murphy teaches nothing more than that increasing the spacing between the two ground planes decreases radiation at zenith (while radiation at low angles increases) and vice versa.

Thus, in effect, the Examiner has cited Murphy essentially for its teaching of increasing gain at low angles by increasing the distance between the radiator ground plane and the primary ground plane. However, in the quote above, the Examiner asserts that it would be obvious (i.e., that Murphy suggests) to decrease the distance between his two ground planes in order to increase radiation at zenith (at the expense of radiation at low angles). Thus, the Examiner is asserting that Murphy contains two relevant teaches that are the opposite of each other. This, of course, is not possible.

The fact of the matter is that the prior art of record really does not suggest either because, as noted above, the two references do not adequately suggest any combination thereof. They just teach two different ways of achieving a similar result with no suggestion that a combination thereof would provide any synergistic result toward achieving that goal. In fact, as noted above, it is quite likely that combining the two techniques would lead to a very undesirable result, such as a radiation pattern that is too narrow or a radiation pattern that restores gain at the zenith and decreases it at low angles.

## II. The Combination Does not Result in the Claimed Invention In Any Event

The proposed combination does not result in the claimed invention in any event.

### A. The Independent Claims

As discussed in the specification of the present application, Applicant does not want to reduce gain at zenith. Applicant's invention is particularly adapted for use with satellite radio such as the XM™ and Sirius™ satellite radio systems, in which some satellites are positioned at a fairly low angle to the horizon in order to cover a large geographic area with a small number of satellites (about 2 to 4). At least one of these satellite radio systems also uses another satellite close to the zenith. Accordingly, it is important to have excellent low angle gain while not substantially diminishing gain at zenith. Hence, Applicant's invention achieves increased gain at low angles while not significantly decreasing gain at zenith.

However, Murphy's Figure 5 clearly illustrates that Murphy's concept of radiating directly out of the radiator at low angles is at the sacrifice of gain near zenith. Specifically, as the height of the upper ground plane above the lower ground plane increases, the gain at zenith decreases while the low angle gain increases. This is contrary to Applicant's goals and thus the proposed combination does not achieve the goals of the present invention.

Both independent claims, claim 1 and 15, expressly recite that the gain at zenith is not significantly reduced.

This is contrary to the teachings of Murphy. Thus, even if we were to accept for the purposes of argument that the proposed combination of Openlander and Murphy would result in increase low angle gain (an assertion that Applicant strongly disputed in section I.B.2), it would not result in the present invention as claimed, in any event.

### B. The Dependent Claims Further Distinguish Over the Prior Art of Record

Furthermore, the dependent claims add even further patentably distinguishing recitations.

For instance, claims 26-28, and 31-33 recite specific values for radiation gain at specific angles relative to the same antenna without a lens. The Examiner has rejected these claims in view of the combination of Openlander with Murphy asserting that, even though the references do not disclose these particular gains, specific magnitudes of gains at a particular angle are limitations strictly dependent upon the material and thickness of the lens.

Applicant respectfully traverses. The Examiner appears to be asserting that, given the basic invention, achieving any particular gain at any particular angle is a matter of design specification. The Examiner is misinterpreting the importance of these claim recitations. The importance of these claim recitations is not merely the ability to achieve these gains at these specific angles, if desired. Rather, it is the discovery that they are particularly desirable specifications.

For instance, in connection with digital satellite radio in North America, such as that provided under the trade names XM™ and Sirius™, satellites are positioned at a fairly low angle to the horizon in order to cover a large geographic area with a small number of satellites (about 2 to 4). At least one of these satellite radio systems also uses a satellite close to the zenith. Accordingly, it is important to have excellent low angle gain while not substantially diminishing gain at zenith. This is achieved by the present invention, as described in the specification. Accordingly, antennas designed in

accordance with the present invention that meet the limitations set forth in claims 26, 27, 28, 31, 32, and 33 work particularly well for these satellite radio applications.

Hence, dependent claims 26-28 and 31-33 further patentably distinguish over the prior art of record.

Respectfully submitted,

Dated: January 23, 2006

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## APPENDIX A: CLAIMS INVOLVED IN THIS APPEAL

1. A microstrip antenna comprising:
a first conductive ground plane;
a dielectric substrate disposed on the first ground plane;
a patch disposed on the dielectric substrate;
feed means for electrically feeding the patch;
a dielectric lens for encapsulating at least a portion of the patch to increase radiation gain at an angle less than 45 degrees to said patch without significantly decreasing gain at zenith; and
a second ground plane formed between the dielectric substrate and the first ground plane for raising the patch and further increasing the radiation gain at angles less than 45 degrees.

3. The microstrip antenna of claim 1, wherein the first and second ground planes are disposed such that a space is created between the first and second ground planes for providing additional elements therein.

4. The microstrip antenna of claim 1, wherein the dielectric lens covers completely the top of the patch and the dielectric substrate.

5. The microstrip antenna of claim 1, further comprising:
an air gap disposed between the patch and the dielectric lens.

7. The microstrip antenna of claim 1, wherein the dielectric lens has a dome configuration.

8. The microstrip antenna of claim 1, wherein the first ground plane is flat and the dielectric substrate is disposed directly on the first ground plane.

9. The microstrip antenna of claim 1, further comprising:

an additional antenna element disposed through the patch, the dielectric substrate, the ground plane, and the dielectric lens.

10. The microstrip antenna of claim 9, wherein the additional antenna element is a monopole.

11. The microstrip antenna of claim 10, further comprising:

a dielectric cap disposed around the monopole.

12. The microstrip antenna of claim 1, further comprising:

a monopole disposed through the patch, the dielectric substrate, the second ground plane and the dielectric lens; and

a dielectric cap surrounding the monopole, whereby a dual-function antenna is provided.

13. The microstrip antenna of claim 12, further comprising:

an air gap disposed between the patch and the dielectric lens.

14. The microstrip antenna of claim 1, wherein the feed means includes a feed pin disposed through the patch, the dielectric substrate and the ground plane.

15. A method of providing a microstrip antenna, comprising the steps of:

providing a first conductive ground plane;

providing a dielectric substrate on the ground plane;

providing a patch on the dielectric substrate;

providing feed means for feeding the patch;

providing a dielectric lens encapsulating at least a portion of the patch to increase radiation gain at angles less than 45 degrees while not significantly reducing gain at zenith; and

providing a second conductive ground plane between the dielectric substrate and the first ground plane for raising the patch and further increasing the radiation gain at low angles.

17. A method of providing a microstrip antenna, comprising the steps of:

providing a first conductive ground plane;

providing a dielectric substrate on the ground plane;

providing a patch on the dielectric substrate;

providing feed means for feeding the patch;

providing a dielectric lens encapsulating at least a portion of the patch to increase radiation gain at angles less than 45 degrees while not significantly reducing gain at zenith; and

providing a second conductive ground plane between the dielectric substrate and the first ground plane for raising the patch and further increasing the radiation gain at low angles, wherein the second ground plane includes at least one slant portion, and a flat portion for disposing thereon the patch, and wherein the first ground plane is entirely flat.

18. The method of claim 15, wherein the first ground plane is entirely flat and the dielectric substrate is disposed directly on the first ground plane.

19. The method of claim 15, further comprising the step of:

providing an additional antenna element disposed through the patch, the dielectric substrate, the second ground plane, and the dielectric lens.

20. The method of claim 19, wherein the additional antenna element is a monopole.

21. The method of claim 19, further comprising the step of:

providing a dielectric cap disposed around the monopole.

22. The method of claim 19, further comprising the step of:
providing an air gap between the patch and the dielectric lens.

23. The method of claim 15, wherein, in the step of
providing the feed means, the feed means includes a feed pin disposed through the patch, the dielectric substrate and the ground plane.

24. The microstrip antenna of claim 1 wherein said dielectric lens is disposed directly on said patch.

25. The microstrip antenna of claim 15 wherein
said dielectric lens is disposed directly on said patch.

26. The microstrip antenna of claim 1 wherein said radiation gain is increased by about at least 0.5 dB at about 35 degrees relative to a microstrip antenna without said dielectric lens that is otherwise the same as said microstrip antenna.

27. The microstrip antenna of claim 25 wherein said radiation gain is increased by at least about 2.5 dB at 24 degrees relative to a microstrip antenna without said dielectric lens that is otherwise the same as said microstrip antenna.

28. The microstrip antenna of claim 27 wherein said radiation gain is increased by at least about 3 dB at 24 degrees relative to a microstrip antenna without said dielectric lens that is otherwise the same as said microstrip antenna.

29. The microstrip antenna of claim 15 wherein said dielectric lens is disposed directly on said patch.

30. The method of claim 15 wherein said dielectric lens provides increased radiation gain at an angle as low as 24 degrees.

31. The microstrip antenna of claim 15 wherein said radiation gain is increased by about at least 0.5 dB at about 35 degrees relative to a microstrip antenna without said dielectric lens that is otherwise the same as said microstrip antenna.

32. The method of claim 30 wherein said radiation gain is increased by at least about 2.5 dB at about 24 degrees relative to a microstrip antenna without said dielectric lens that is otherwise the same as said microstrip antenna.

33. The method of claim 32 wherein said radiation gain is increased by at least about 3 dB at about 24 degrees relative to a microstrip antenna without said dielectric lens that is otherwise the same as said microstrip antenna.

34. The microstrip antenna of claim 4 wherein the dielectric lens is positioned with respect to said patch such that all forward radiation emanating from said patch or received at said patch passes through said lens.

35. The microstrip antenna of claim 15 wherein the dielectric lens covers completely the top of the patch and the dielectric substrate.

36. The method of claim 31 wherein the dielectric lens is positioned with respect to said patch such that all forward radiation emanating from said patch or received at said patch passes through said lens.